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September 28, 2000

Attorney Docket No.: 06618-517001

**Box Patent Application**  
Commissioner for Patents  
Washington, DC 20231

Presented for filing is a new patent application claiming priority from a provisional patent application of:

Applicant: ERIK K. ANTONSSON

Title: PROGRAMMABLE GAS GENERATOR USING MICROCELLS

Enclosed are the following papers, including those required to receive a filing date under 37 CFR §1.53(b):

	<u>Pages</u>
Specification	6
Claims	4
Abstract	1
Declaration	[To be Filed at a Later Date]
Drawing(s)	5

Enclosures:  
— Postcard.

There are 15 total claims, 3 of which are independent.

Under 35 USC §119(e)(1), this application claims the benefit of prior U.S. provisional application 60/156,629, filed September 28, 1999; 60/159,931 filed October 14, 1999; 60/170,130 filed December 10, 1999; and 60/159,943 filed October 14, 1999.

## CERTIFICATE OF MAILING BY EXPRESS MAIL

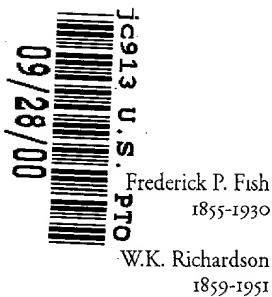
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Frederick P. Fish  
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W.K. Richardson  
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Small entity status established in the parent case is still proper and desired.

Basic filing fee	\$0
Total claims in excess of 20 times \$9	\$0
Independent claims in excess of 3 times \$39	\$0
Fee for multiple dependent claims	\$0
Total filing fee:	\$0

No filing fee is being paid at this time.

If this application is found to be incomplete, or if a telephone conference would otherwise be helpful, please call the undersigned at (858) 678-5070.

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Respectfully submitted,



Scott C. Harris  
Reg. No. 32,030  
Enclosures  
SCH/rpi  
10056272 doc

APPLICATION  
FOR  
UNITED STATES LETTERS PATENT

TITLE: PROGRAMMABLE GAS GENERATOR USING  
MICROCELLS

APPLICANT: ERIK K. ANTONSSON

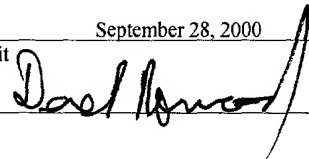
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PROGRAMMABLE GAS GENERATOR USING MICROCELLS

The present application claims priority under 35 USC 120  
5 from provisional application number 60/156,629, filed 9/28/99;  
60/159,931, filed 10/14/99; 60/170,130, filed 12/10/99; and  
60/159,943; filed 10/14/99.

BACKGROUND

10 Many different applications use gas generation. A few of  
these applications include thrusters for satellites, air bags,  
cylinders, hydraulics and the like.

SUMMARY

15 The present application teaches programmable microcells  
which provide programmable amounts of gas generation. A  
controller selects which of the programmable cells will fire  
at any given time.

The system enables precise control of the rate, timing  
20 and amount of gas that is generated. This can be used in  
combination with sensors to select one of a plurality of  
stored profiles.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects will be described in detail with respect to the accompanying drawings wherein:

Figure 1 shows a basic programmable gas generator;

5 Figure 2 shows a system with two gas outlets;

Figure 3 shows a basic cell of propellant;

Figure 4 shows a system driving a cylinder;

Figure 5 shows a cylindrical system;

Figure 6 shows a system driving a turbine; and

10 Figure 7 shows an airbag embodiment, with a programmable device in a vehicle, which includes sensors, controlling the output and profile of airbag deployment.

DETAILED DESCRIPTION

15 The present application shows and describes a number of different forms of programmable gas generators.

Figure 1 shows an embodiment in which a plenum 100 is formed by walls of a cavity 102. The walls of the cavity 102 terminate in a gas outlet 104 which can feed any of the above-  
20 described applications - e.g., thrusters for satellites, air bags, cylinders and/or hydraulics. Each initiation produces a measured amount of gas at the gas outlet 104.

A digital propulsion chip 120 is formed from the plurality of units 130. Each unit includes an initiator 132

connected to its own initiation line 134. The initiator 132 is connected to activate a fuel element 136, which can be a solid fuel element, for example.

A cover layer 138 includes bursting spots 140, each of which being a spot where the strength of the diaphragm is intentionally degraded. The gas exhausts from the bursting spot when the propulsion chamber is ignited, and the diaphragm is pierced by the expanding gas.

In operation, the initiators can be individually initiated to produce gas output. Each initiator produces a known amount of gas output, which may be constant to within a specified resolution. The position of exhaust gas to the elements is also known.

The controller 199 controls how many initiators to execute, and may also controls them in a specified order. The controller may also include a non volatile memory 198, which keeps track of which initiators have been operated. The controller can be a processor or digital computing device.

Figure 2 shows an alternative system in which there are two gas outlets 104 and 200.

Figure 3 shows a more detailed embodiment of a single gas generation unit 130. Each of the units include a housing portion 200 which is substantially filled with propellant. A glass spacer part 210 forms the walls which contain the

propellant in the housing. A resistor 225 heats up to ignite the propellant. Once ignited, the propellant expands through burst portion 230 in the diaphragm. A metal trace 238 is also provided to restrain debris from going to undesired locations.

5 An alternative embodiment is shown in Figure 4, in which the device is 400 are located in a cavity whose outlet 405 drives a piston 410. The volume 415 within the piston controls the movement of the piston. By expanding the volume, the piston moves, thereby producing a programmable amount of  
10 work.

Figure 5 shows another embodiment which is formed by a cylindrical plenum. One or more gas generators 505 are located around the outside of the cylindrical plenum. The gas generators are arranged circumferentially around the edges of  
15 the chamber. A plurality of gas generators around the periphery may allow better distribution of the produced gas amounts.

Figure 6 shows the plenum 600, with gas generation elements being located on opposite surfaces, e.g., on the  
20 surface 610 and on the opposing surface 615. The generation elements drive a turbine 620, which turns to produce some work or some indication of the amount of gas output. The gas is then outlet through the outlet 625.

The programmability in this system can be achieved by selecting the number and order of activation, in order to select the timing rate and amount of gas that is generated. The controller can calculate the amount of gas to be produced, and can ignite the specified cells to produce the gas output.

One or more sensors may be integrated with or used in conjunction with one or more of the programmable gas generators. This can be used, for example, to select or modulate the timing rate, amount or profile of gas generation as a function of time. The controller 199 includes a microprocessor which may compute a timing rate amount or profile of gas generator adjacent as a function of time prior to, during or after the acceleration.

In one specific use, different scenarios can be modeled in advance. An ideal gas production profile for each scenario is obtained from the modeling, and is stored in the controller 199.

At any time, current information is compared against the scenarios in memory, and a best match scenario is selected.

That best match is used to produce a gas production profile.

An embodiment shown in Figure 7 uses a programmable gas generation chip that drives an airbag deployment device 703. One or more acceleration sensors 700, 702 may determine the severity of acceleration or deceleration of an automobile.



This information is coupled to the controller 199 which has a look up table storing amounts of deceleration correlated with expected severity of a crash and ideal airbag deployment for that severity. The amount of deceleration selects the profile  
5 of airbag deployment; e.g., the amount and speed of opening of the air bag information. This is then used to generate an air bag inflation which is matched to the profile of the current deceleration/acceleration.

Other sensors 722 may determine the speed of the vehicle  
10 at the time of the acceleration, the weight of the vehicle, seat position, thermal sensors which detect the presence or size of the passenger in the vehicle; rate or proximity sensors may also detect information such as proximity or rate of approach, etc. Data from each of these sensors can be  
15 included into the controller; and used to set the profile of the airbag deployment.

Although only a few embodiments have been disclosed in detail above, other modifications are possible.

What is claimed is:

1. A programmable gas generator, comprising:

a controller, receiving information indicating an amount  
5 of gas to be generated; and

a programmable multipart propulsion chip, having a  
plurality of individually accessible gas generation elements,  
each of which is accessible to produce a gas output, and each  
of which, once activated, produces a measured amount of gas,  
10 said chip being activated by said controller based on said  
amount of gas to be generated.

2. A generator as in claim 1, wherein said propulsion  
chip is used to drive an air bag, and wherein said controller  
15 includes a sensor which senses at least one parameter.

3. A device as in claim 1, wherein each said element  
includes a debris restraining part.

20 4. A device as in claim 1, wherein said plurality of  
devices are located on opposing surfaces.

5. A device as in claim 1, wherein said chamber is cylindrical and said plurality of devices are circumferentially spaced from one another.

5 6. A generator as in claim 1, further comprising storing a plurality of profiles of air bag deployment to drive said individually accessible gas generation elements, sensing current characteristics, and selecting one of said profiles and using said one profile to drive the elements.

10 7. A generator as in claim 1 wherein each of said gas generation elements includes a bursting spot, having a strength which is intentionally degraded, so that the element bursts at said bursting spot.

15 8. A generator as in claim 1, wherein said plurality of gas generation elements are arranged in a circumferential direction.

20 9. A generator as in claim 1, further comprising a cylindrical combustion chamber, containing said gas generation elements.

10. A generator as in claim 9, wherein said combustion chamber has at least one cylindrical wall, and further comprising placing said said gas generation elements against a wall of said cylindrical combustion chamber.

5

11. A method of operating an airbag, comprising:

providing a plurality of sensors in an installed vehicle, each said sensor sensing a characteristic of operation of the installed vehicle;

10 providing a programmable propulsion chip, which produces an amount of gas output indicative of a control that is applied thereto, wherein said amount is controllable on individual unit basis; and

15 storing a plurality of airbag inflation profiles and selecting one of said profiles based on said sensor characteristic.

12. A method as in claim 11 wherein said sensors include an acceleration sensor.

20

13. A method as in claim 11 wherein said sensors include a weight sensor.

14. A method as in claim 11 wherein said sensors include a sensor which senses positions of different bodies within the vehicle.

5 15. An airbag deployment system, comprising:

a sensor, sensing at least a deceleration of the vehicle;

a memory, storing a plurality of profiles of airbag deployment, said plurality of profiles based on a kind of deceleration and ideal profiles for said kind of deceleration;

10 and

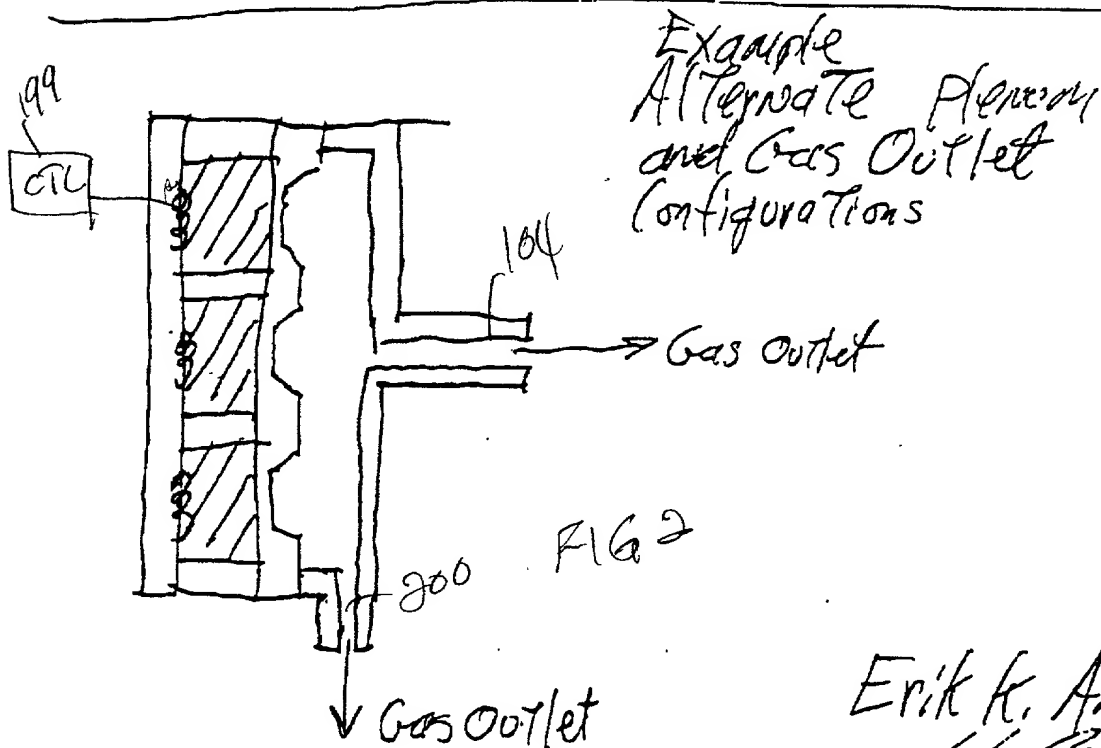
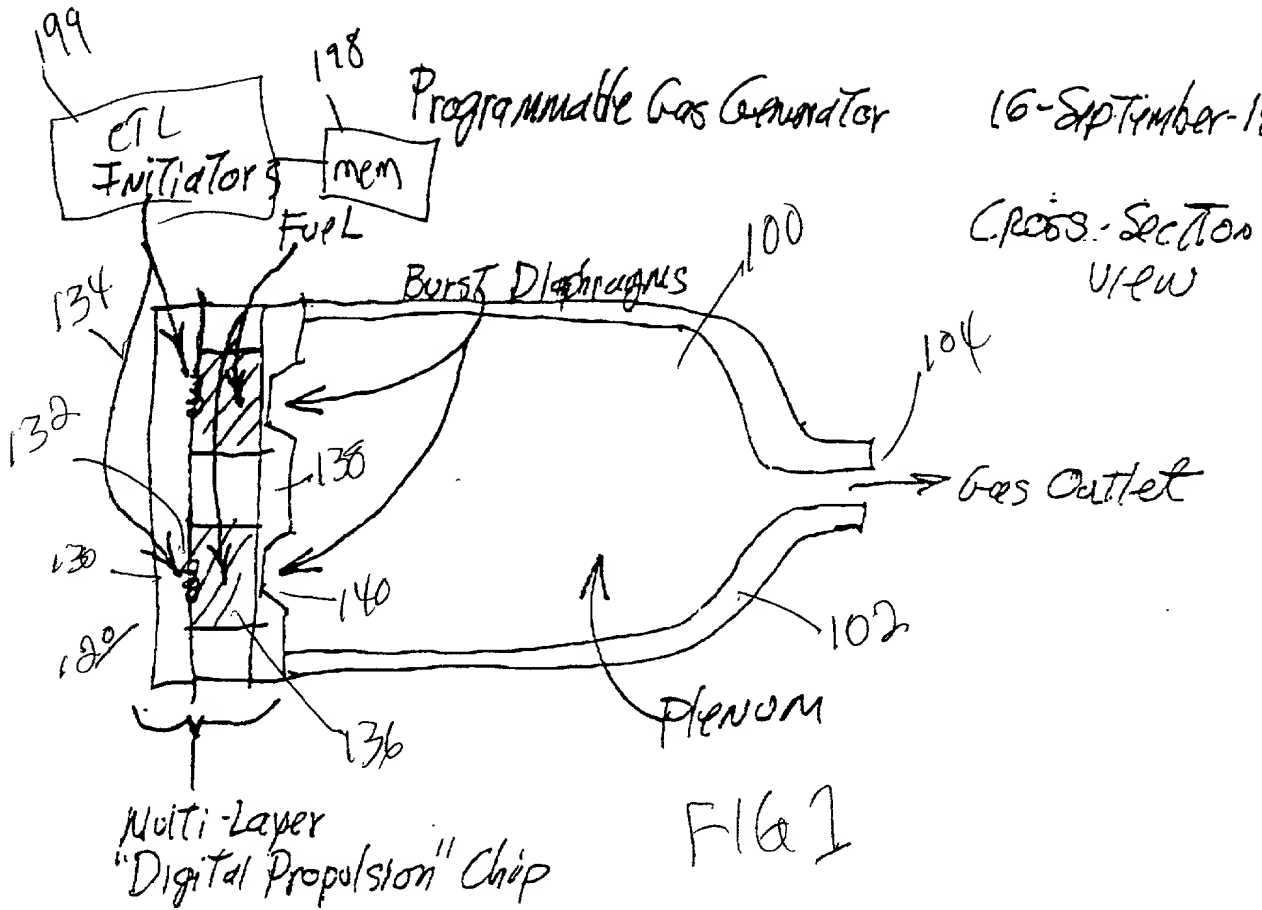
a programmable multipart propulsion chip, having a plurality of elements each of which is individually accessible to produce unmeasured gas output, said propulsion chip being driven by said profiles to produce a gas output based on said  
15 profiles.

ABSTRACT

A programmable gas generator which has a plurality of different elements can be individually activated, and wherein the activation causes inflation of a device.

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Read and understood  
JOEL BURDICK 09/16/99

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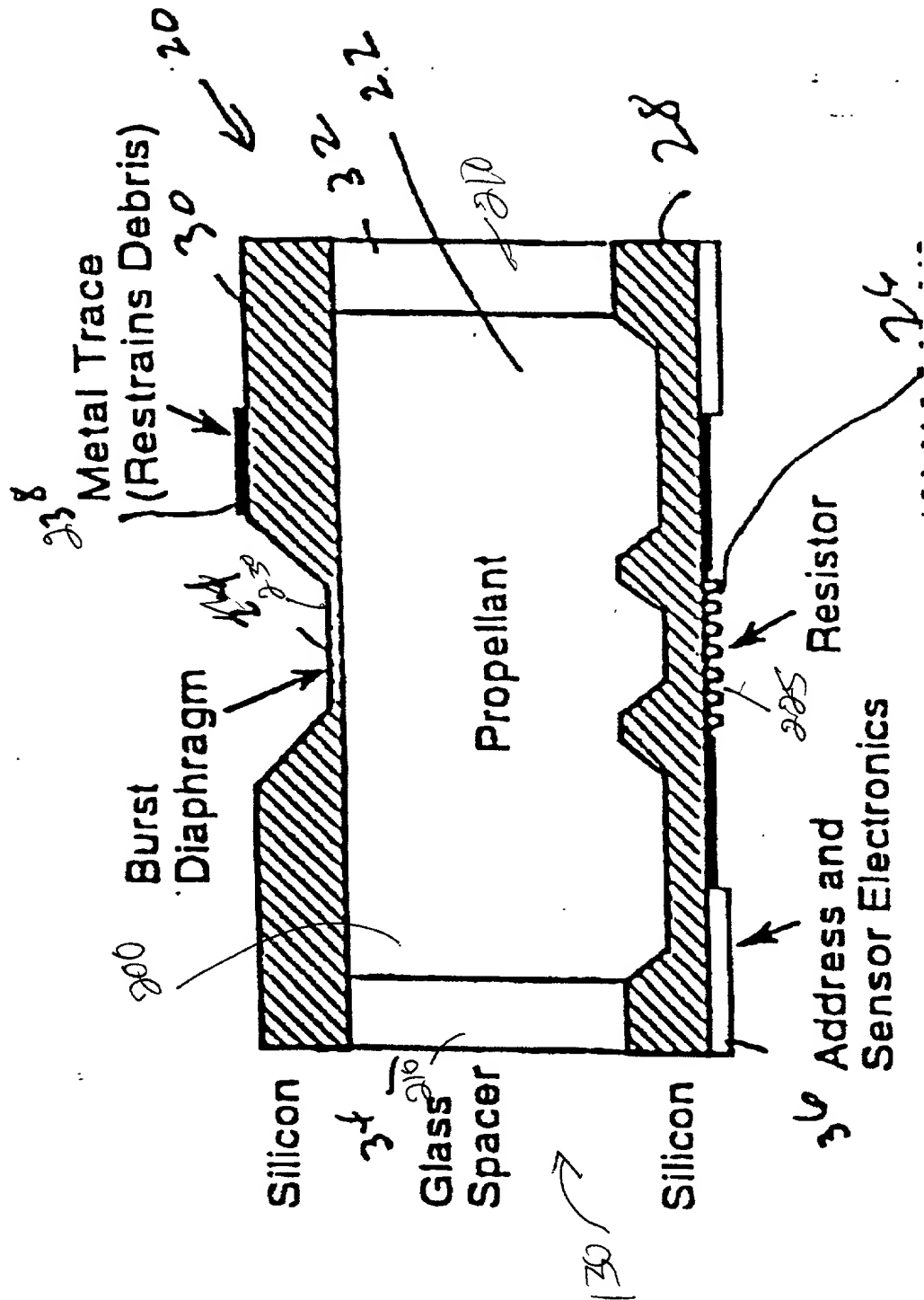
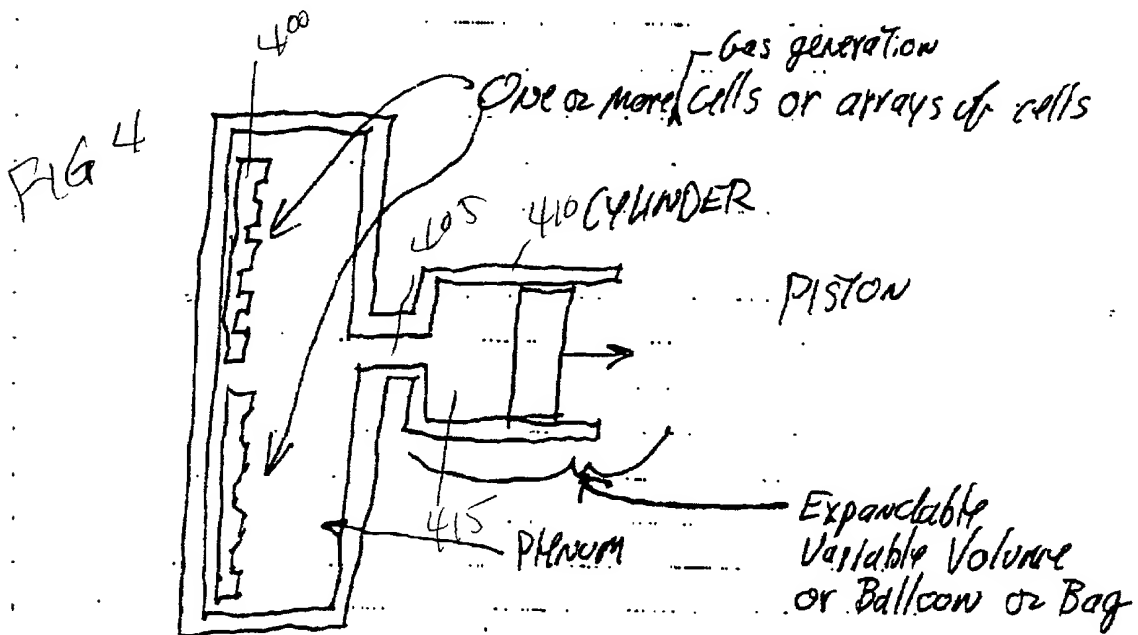
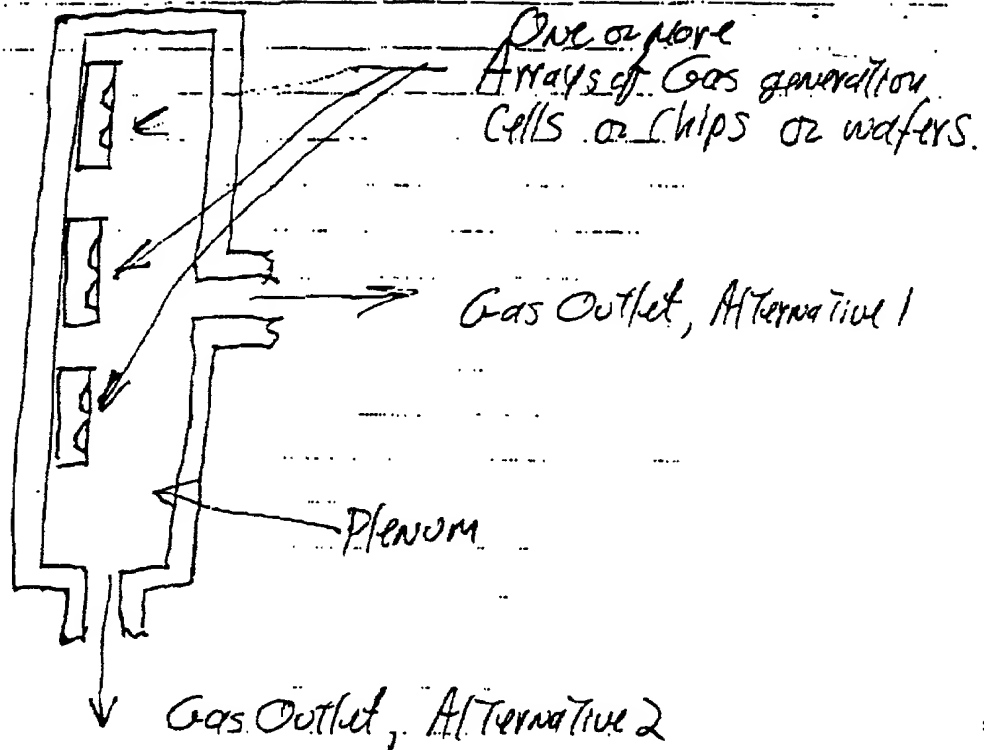


FIG. 3



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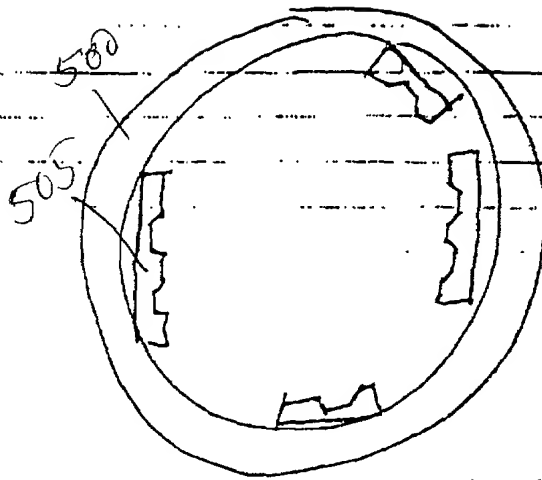


FIG 5

Cylindrical Plenum  
with one or  
more Gas generation  
cells or arrays of  
cells, around the  
periphery.

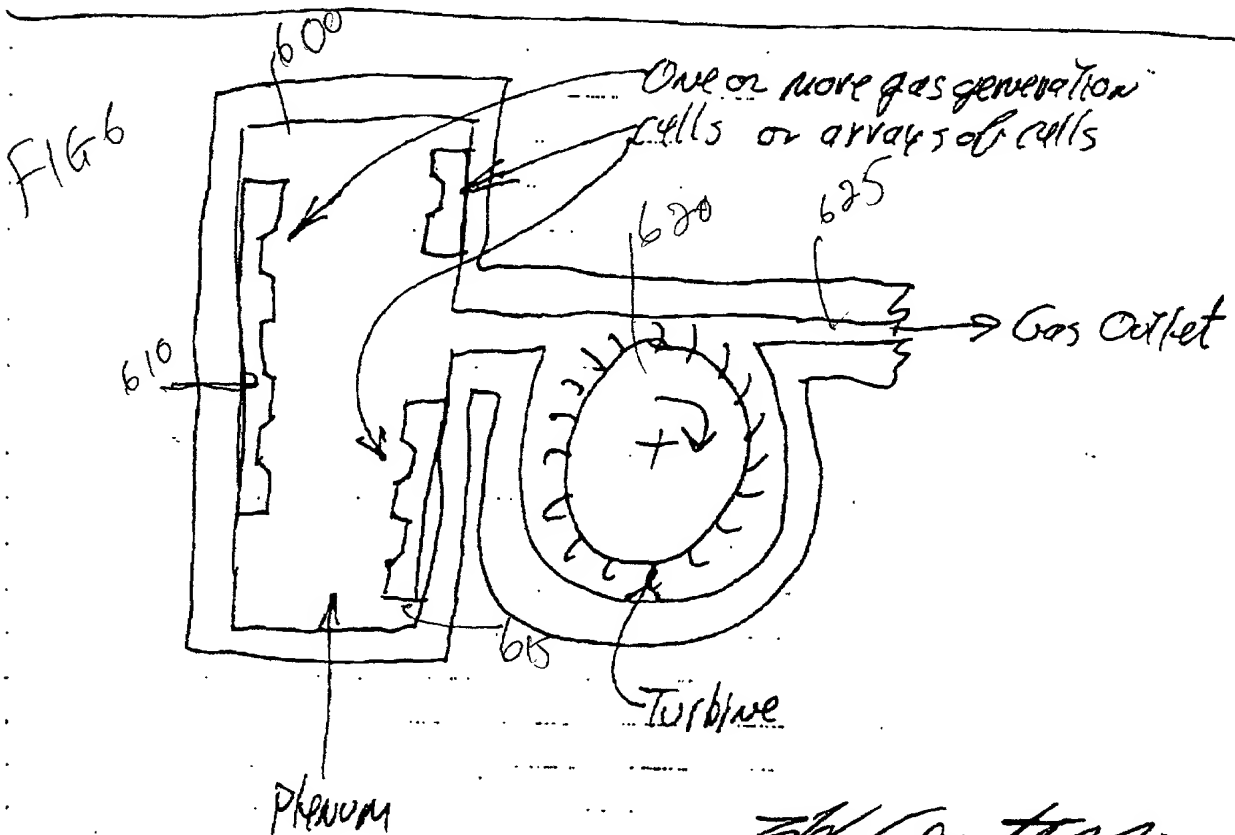


FIG 6

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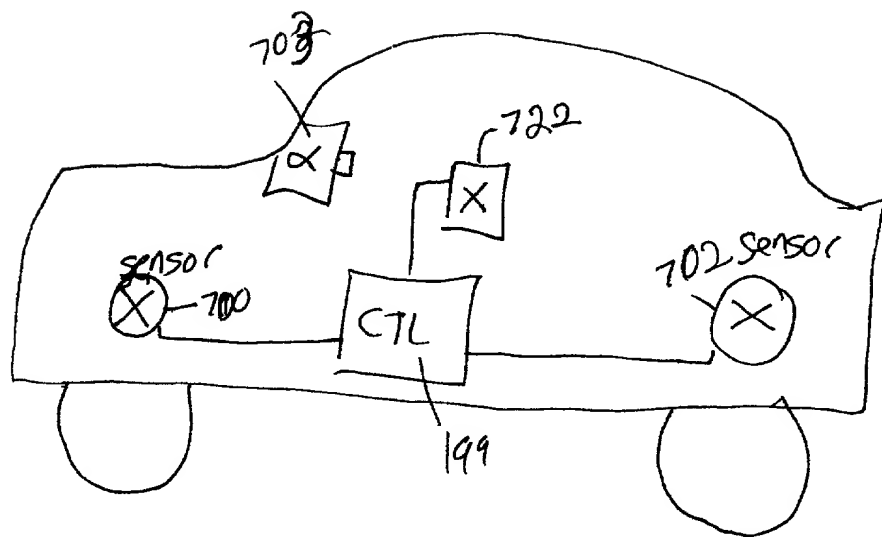


FIG 7